* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
at least two coils (A1 --) which have an active region into the slot (81 91) of the armature winding in the iron part of a rotator (79 89) without a coil, and a stator The stator which contains the field winding (F) which has an active region into the field-winding slot (80 90) in the iron part of a stator so that magnetomotive force may be generated in the direction horizontally extended to the magnetomotive force generated by the armature winding which consists of A2, and the armature winding, The magnetomotive force generated by the current in one coil in an one direction with a period which changes with the period of the magnetomotive force generated in the the opposite direction by the current in one another coil In the electrical machinery and apparatus characterized by having the control means which is synchronized with rotation of the above-mentioned rotator and controls the current in a coil (A1 and A2) While the above-mentioned armature-winding slot and the above-mentioned field-winding slot are the same numbers, in the iron part of the above-mentioned stator, it is arranged by turns. The width of face of a slot (80, 81, 90, 91) is taken into consideration, respectively as width of face of the slot in the hand of cut of rotator at its maximum. The depth of each slot is taken into consideration as the maximum depth of the radial slot of a rotator. Moreover, the thickness of the back iron part behind a slot is taken into consideration as a distance between the thickness of the iron part of the armature in alignment with radial [of a slot / at its maximum / the thickness and radial / same] at its maximum. the width of face of each armature slot (81 91) It is larger than the width of face of each field-winding slot (80 81). The thickness of the back iron part behind each armature-winding slot (81 91) is an electrical machinery and apparatus characterized by being larger than the thickness of the back iron part behind each field-winding slot (80 90).
[Claim 2]
The above-mentioned coil (A1 and A2) is an electrical machinery and apparatus according to claim 1 characterized by carrying out magnetic coupling closely.
[Claim 3]
The thickness of the back iron part behind the above-mentioned armature-winding slot (81 91) is an electrical machinery and apparatus according to claim 1 or 2 characterized by at least 10% being large rather than the thickness of the back iron part behind the above-mentioned field-winding slot (80 90).
[Claim 4]
The thickness of the back iron part behind the above-mentioned armature-winding slot (81 91) is an electrical machinery and apparatus given in claim 1 characterized by being larger than the thickness of the back iron part behind the above-mentioned field-winding slot (80 90) to 100% thru/or any 1 term of 3.
[Claim 5]
The width of face of the above-mentioned armature-winding slot (81 91) is an electrical machinery and apparatus given in claim 1 characterized by about 20% thru/or the thing large 80% rather than the width of face of the above-mentioned field-winding slot (80 90) thru/or any 1 term of 4.
[Claim 6]
The depth of the above-mentioned armature-winding slot (81 91) is an electrical machinery and apparatus given in claim 1 characterized by being smaller than the depth of the above-mentioned field-winding slot (80 90) thru/or any 1 term of 5.
[Claim 7]
The above-mentioned slot (80, 81, 90, 91) is an electrical machinery and apparatus given in claim 1 characterized by having narrow opening which counters with the above-mentioned rotator (79 89) between the poles where the above-mentioned stator (78 88) adjoins each other thru/or any 1 term of 6.

[Claim 8]
The above-mentioned stator (78) has a circular cross section substantially. The depth of the above-mentioned armature-winding slot (81) is the electrical machinery and apparatus of claim 1 characterized by being smaller than the depth of the above-mentioned field-winding slot (80) so that the thickness of the back iron part behind the above-mentioned armature-winding slot may be increased thru/or seven publications.
[Claim 9]
The above-mentioned stator (88) has a polygonal cross section on a real target including an angle (86). The above-mentioned active region of the above-mentioned armature-winding slot (91) is an electrical machinery and apparatus given in claim 1 characterized by being in the location which adjoined the above-mentioned angle in order to make the thickness of the back iron part behind the above-mentioned armature-winding slot increase thru/or any 1 term of 7.
[Claim 10]
The above-mentioned stator (78 88) has two or more poles. The above-mentioned armature winding is an electrical machinery and apparatus given in claim 1 characterized by being wound in the pitch of two or more above-mentioned poles, and the corresponding pitch thru/or any 1 term of 9.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
This invention relates to an electrical machinery and apparatus.
[0001]
The stator 2 which contains in drawing 1 a and 1b two groups 3 and 4 of the pole which it has been mutually arranged in the opposite direction and was projected to the inner sense which are the conventional 2 phase adjustable magnetic-reluctance motors, and have two groups 5 and 6 of the excitation winding corresponding to two phases, A thing equipped with the rotator 7 containing one group 8 of the pole without a coil which it has been mutually arranged in the opposite direction and was projected outward is shown. Sign Y-Y which shows two completely opposite parts of each coil in the group 6 of a coil Sign X-X which shows two completely opposite parts of each coil in the group 5 of a coil Four excitation winding is twisted around the corresponding pole, respectively as displayed. By exciting the coil of a stator by turns synchronizing with rotation of a rotator, an excitation circuit (not shown) produces torque for the property of the flume detour trochanter 7 to which an own location is changed so that magnetic reluctance may be minimized all over the magnetic field generated by the coil, and it has it in order to rotate the rotator 7 in a stator 2, so that it may explain in full detail below. Such an adjustable magnetic-reluctance motor offers the advantage of not needing the commutator and brush which are the member worn out as compared with the conventional coil motor in order to supply a current to a rotator. Furthermore, there is no conductor in a rotator, and since the expensive permanent magnet is unnecessary, an advantage is offered.
[0002]
Sign + and - which are shown in drawing 1 a and 1b show the direction of the current in the inside of a coil in two different excitation modes whether it is drawn by the rotator 7 to either the horizontal position shown in drawing, or a vertical position. Moreover, rotation of a rotator 7 needs to excite the groups 5 and 6 of a coil by turns, at once, excites only either of the groups 5 or 6 of a coil preferably, and usually supplies a current only to an one direction in this excitation at the groups 5 or 6 of each coil. However, at the maximum, in order to generate useful torque, supposing a coil is excited, in such a motor, the use effective in the altitude of an electrical circuit only of half time amount will become impossible in the inside of one revolution.
[0003]
To the above and the contrary, it is a wale (J. D.Wale). And are based on Pollock (C.Pollock). The coil of "full pitch New transducer topology of 2 phase switch magnetic-reluctance motor which it has () [Novel Converter Topologies for a Two-Phase Switched Reluctance Motor with] Fully Pitched Windings", an IEEE power engineer conference (IEEE Power Electronics Sepecialists Conference), As shown in 1798 pages - 1803 pages in BURABINO (Braveno) and June, 1996 As shown in drawing 2 (same reference mark was used about the same member as what is shown in drawing 1 a and 1b) a, and 2b, moreover, 2 phase adjustable magnetic-reluctance motor of full pitch In the example to illustrate, it has a pitch twice the pitch of the pole of the motor which is 180 degrees, and two coils 10 and 11 each other arranged at the include angle of 90 degrees are included. The coil 11 is twisted so that the stator slot (slot) 12 as which a part of coil in one side face of a rotator 7 is specified between the poles where the groups 3 and 4 of a pole adjoin each other may be fulfilled and the stator slot 13 as which a part of another near coil 11 of completely the contrary of a rotator 7 is specified between two poles which adjoin the above of the groups 3 and 4 of a pole may be fulfilled. The coil 10 has a corresponding part which fulfills the stator slots 14 and 15 which are completely in an opposite location. So, two coils 10 and 11 have spread over the width of face of a motor on the shaft of the coils 10 and 11 which intersect perpendicularly mutually.
[0004]

Furthermore, although coils 10 and 11 are excited in both both excitation modes in two different excitation modes of such a motor corresponding to the horizontal position and vertical position of a rotator 7 as shown in drawing 2 a and 2b, and the direction of the current in a coil 10 is the same also in which mode, on the other hand, the directions of the current in a coil 11 differ in the two modes. Since the current was supplied to the coils 10 and 11 for both synchronizations in both modes and each coil 10 and 11 occupies the one half of all the slot fields of a stator, such a system can attain 100% of use of the slot field. This is contrastive with 50% of use attained in the conventional coil adjustable magnetic-reluctance motor by which only one coil for a synchronization is excited at once, and which was mentioned above. Furthermore, since it is not necessary to change the direction of a current in a coil 10, it is a field winding (field winding) below. Switching can supply an unnecessary direct current to the coil 10 to call, and the excitation circuit therefore used can be simplified. However, the coil 11 called an armature winding (armature winding) below must be excited by the current which changes synchronizing with the location of a rotator in order to determine the change direction of the magnetic flux of a stator required in order to lead a rotator to a horizontal position or a vertical position by turns. Such a motor can be called "a magnetic-flux switch motor (flux-switching motor)." In the above motors, since it is necessary to supply an alternating current to an armature winding, it will become an excitation circuit very complicated as a result, and expensive.

[0005]

SURANO (J. R.Surano) ONGU (C-M Ong) Depend. "The adjustable magnetic-reluctance motor structure by low-speed actuation (Variable Reluctance Motor Structures for Low-Speed Operation)", The IEEE transaction for industrial application (IEEE Transactions on Industry Application), 32 volumes, No. 2, four March, 1996 / months, and 808 Page -815 A page and British patent (UK Patent) The 2262843rd The number is indicating 2 phase adjustable magnetic-reluctance motor of full pitch. British patent 2262843rd The motor indicated by the number is a three-phase-circuit adjustable magnetic-reluctance motor which must be excited by the current which synchronized with rotation of a rotator and which has three coils, and needs the excitation circuit where such a motor is very complicated.

[0006]

WO 98/05112 As typically shown in drawing 3, 2 phase adjustable magnetic-reluctance motor of full pitch equipped with the stator 2 of four poles is indicated. The stator 2 of the four above-mentioned pole is divided in two coils 22 and 23 which combined closely the above-mentioned field winding 10 and the armature winding 11, respectively, or 24 and 25 including a field winding 10 and an armature winding 11. The opposite part of each coil is completely twisted so that it may completely be arranged at the slot of an opposite stator. Drawing 4 shows the circuit diagram generalized for exciting armature coils 24 and 25. It connects in the circuit so that supply of a direct current to terminals 26 and 27 may flow in the same direction in the both sides of coils 24 and 25, and since coils 24 and 25 have the the opposite volume of a coil, they produce the magnetomotive force to the the opposite direction. For example, since the switches 28 and 29 which consist of a field-effect transistor or a thyristor are switched by turns so that it may connect with coils 24 and 25 at a serial, respectively and coils 24 and 25 may be excited by turns, they supply the magnetomotive force committed in the the opposite direction needed. It is the advantage of the above configurations that an armature winding consists of two coils combined closely, and each coil is excited with the current of only an one direction, consequently can use a comparatively easy excitation circuit.

[0007]

In GB No. 18027 on September 9, 1901, in order to supply the interaction with a rotator needed, the adjustable magnetic-reluctance device equipped with the group of the coil on a stator excited by turns is indicated. Furthermore, GB 554827 In the number, the AC generator by the inductor with which it has the field winding and the auxiliary coil for currents on the stator is indicated so that the excitation which generates continuously by turns the field where magnetic reluctance is comparatively high, and a low field, and is needed by relative arrangement of the dentate part of a stator and a rotator may be affected. However, each of these advanced technology is WO 98/05112. It does not have an advantageous property in a configuration.

[0008]

The purpose of this invention is by low cost comparatively to offer the electrical machinery and apparatus which can attain high power efficiency.

[0009]

The armature winding which becomes the slot of the armature winding in the iron part (iron) of the rotator in which the electrical machinery and apparatus concerning this invention does not have a coil, and a stator from at least two coils which have an active region, And the stator which contains in the field-winding slot

in the iron part of a stator the field winding which has an active region so that magnetomotive force may be generated in the direction horizontally extended to the magnetomotive force generated by the armature winding, The magnetomotive force generated by the current in one coil in an one direction with a period which changes with the period of the magnetomotive force generated in the the opposite direction by the current in one another coil In the electrical machinery and apparatus characterized by having the control means which is synchronized with rotation of the above-mentioned rotator and controls the current in a coil While the above-mentioned armature-winding slot and the above-mentioned field-winding slot are the same numbers, in the iron part of the above-mentioned stator, it is arranged by turns. The width of face of a slot is taken into consideration, respectively as width of face of the slot in the hand of cut of a rotator at its maximum. The depth of each slot is taken into consideration as the maximum depth of the radial slot of a rotator. Moreover, the thickness of the back iron part behind a slot is taken into consideration as a distance between the thickness of the iron part of the armature in alignment with radial [of a slot / at its maximum / the thickness and radial / same] at its maximum. It is characterized by the width of face of each armature slot being wider than the width of face of each field-winding slot, and the thickness of the back iron part behind each armature-winding slot being larger than the thickness of the back iron part behind each field-winding slot.

[0010]

According to the above-mentioned configuration, the slot for an armature winding and a field winding is fitted to the characteristic request in a coil, and power efficiency can be optimized while being able to use the quality of a magnetic matter the optimal. Since a field winding conducts only a direct current when the stator has the circular cross section typically, a self-inductance is not comparatively important, and it is made as for the slot of a field winding to a comparatively narrow and deep configuration, without dropping processing effectiveness for this reason. On the other hand, in order to reduce self-inductances, the comparatively large and shallow configuration of the slot of an armature winding is desirable. This guarantees using a back (back) iron part comparatively thick for the coil of a stator so that iron loss may be restricted. Moreover, if it takes into consideration that the magnetic flux accompanying a field winding is substantially fixed, the comparatively thin back iron part behind a field winding will not produce high iron loss.

[0011]

For the more perfect understanding of this invention, the drawing was attached as instantiation for reference.

[0012]

The operation gestalt of this invention shown below is a magnetic-flux switch motor (flux-switching motor) equipped with the stator of four poles, and the rotator of two poles, the above-mentioned stator contains the field winding 10 and the armature winding 11, and the above-mentioned armature winding is related with that from which the opposite part of a coil serves as a configuration distributed to two coils 24 and 25 arranged at the slot of the opposite stator while being combined closely. The above-mentioned armature coil is A1 because of explanation in the following. And A2 It refers to by carrying out.

[0013]

As shown in the circuit diagram of drawing 5 , the field winding 10 is connected to armature coils 24 and 25 and a capacitor 57 at juxtaposition, and the currents which flow to a field winding 10 and armature coils 24 and 25 by this differ. The current is supplied to the above-mentioned circuit from AC power supply 58 through the rectification bridge 59, and it has the switch control circuit 60 in order to supply a current by turns to armature coils 24 and 25 and to supply the required magnetomotive force committed in the opposite direction of [for rotating a rotator]. In this case, two switches 61 and 62 which consist of MOSFETs preferably with a buffer means to have a capacitor 65 and resistance 66, and two diodes 63 and 64 are contained in circuitry 60. A facility of the above-mentioned buffer means is needed because the transfer to the armature coil of another side at the time of cutting of switches 61 and 62 from one armature coil which is momentary and is without a loss is impossible, so uncombined energy is caught, and in order to prevent it destroying a switch, the above-mentioned buffer means is needed.

[0014]

At the time of actuation, the above-mentioned switches 61 and 62 are switched by turns by the switch control circuit of the format which may set on the technique of a motor and is known. For this reason, the detail of the above-mentioned circuit is not indicated in this specification. Since a volume is an opposite direction and armature coils 24 and 25 are excited by turns, synchronizing with rotation of a rotator, the magnetomotive force to an opposite direction is generated by turns. In addition, WO 98/05112

Consideration of indicated different circuitry should understand that deformation of the various circuitry transformed and described above is possible so that clearly.
[0015]
Here, drawing 6 thru/or the explanatory view of 8 showing the magnetic-flux switch motor 67 equipped with the stator 68 of eight poles and the rotator 69 of four poles with the field coil and armature coil which are arranged among stators 68 at the slot (re-entrant) of the sense is referred to. Drawing 6 is two field coil F and two armature coils A1 which were twisted so that the pitch of two poles might be covered. It is shown. Furthermore, two field coil F and two armature coils A2 which were twisted around drawing 7 so that the pitch of two poles might be covered It is shown. Armature coil A1 And A2 It connects with juxtaposition so that it may be equivalent to the coils 24 and 25 which it is arranged at the common slot 71, and connect for every coil of each pair connected to the serial further, or are shown in the circuit diagram of drawing 5 . Moreover, it connects with juxtaposition so that it may connect with a serial or field coil F may also be equivalent to the field coil 10 of drawing 5 . Armature coil A1 And A2 It is combined closely, for example, they are two main tracks (bifilar). It is twisted by the approach. Or you may be the configuration offered by arrangement to which four armature coils and/or four field coils are connected to a serial or juxtaposition.
[0016]
To drawing 6 , the circuit of drawing 5 is an armature coil A1. And an arrow head 72 shows the direction of the magnetic-flux style when generating an one direction current in field coil F. Armature coil A2 Since it is not excited in this mode, in order to make drawing easy to read, it is omitted from drawing 6 . in this case, the dentate parts 1, 3, 5, and 7 of a stator to which the great portion of magnetic flux met the dentate part of the rotator 69 of the location to illustrate -- flowing -- magnetic flux -- a part flows the dentate parts 2, 4, 6, and 8 of a stator very much. In drawing 7 , the circuit of drawing 5 is an armature coil A2. And an arrow head 73 shows the direction of the magnetic-flux style when generating an one direction current in field coil F. Armature coil A1 Since it is not excited in this mode, in order to make drawing easy to read, it is omitted from drawing 7 . In this case, the great portion of magnetic flux flows the dentate parts 2, 4, 6, and 8 of a stator which do not meet the dentate part of the rotator 69 of the location to illustrate, and very much, since a part flows the dentate parts 1, 3, 5, and 7 of a stator, force of magnetic flux which rotates a rotator 69 counterclockwise is done by this. Drawing 8 is the armature coil A1 in actuation of the motor around which the coil was wound as shown in drawing 6 and drawing 7 . And A2 The line of magnetic flux by the current which flows field coil F is shown. The thick continuous line in this drawing is field coil F and an armature coil A1. The line of magnetic flux accompanying excitation is shown, and, on the other hand, a thin dotted line is field coil F and an armature coil A2. The line of magnetic flux accompanying excitation is shown. This is an armature coil A1, while flowing in the iron part of the stator 68 behind field coil F in the direction where magnetic flux is always the same. And A2 As a result of the magnetic-flux reversal by the receiving mutual excitation, it is an armature coil A1. And A2 Back magnetic flux shows that it changes from osmosis saturation (saturation) polar [a certain] to osmosis saturation polar [another], as shown in insertion drawing 75. The magnetic flux in the dentate part of this stator changes from about 0 condition to the condition of one polar osmosis saturation, as shown in the insertion Fig. of drawing 76.
[0017]
According to this invention, the slot of an armature optimizes the engine performance of a motor, and it is designed so that the quality of a magnetic matter may be used most efficiently. Drawing 9 shows the magnetic-flux switch motor 77 equipped with the stator 78 of eight poles, and the rotator 79 of four poles, and is [the comparatively narrow deep slot 80 for a field coil, and] an armature coil A1 in the above-mentioned stator 78. And A2 The comparatively broad shallow slot 81 of a sake is formed. The armature slots 81 are two armature coils A1. And A2 Since it must double, the armature slot 81 must be comparatively shallow so that these slots have become comparatively broad, and a field comparatively thick as an iron part behind an armature coil may be supplied on the other hand, in order to minimize the iron loss accompanying magnetic-flux reversal. On the contrary, since the magnetic flux of the field coil back which is fixed level substantially does not generate high iron loss, the field of the back iron part behind a field coil can be made thinner. So, since what is necessary is to double only with one field coil F in each slot, the field slot 80 can be made comparatively deeply and comparatively narrow. Since only a direct current flows to a field coil about this point, it must be cautious also of a self-inductance not being comparatively important, either. The above arrangement is the armature coils A1 which minimize loss of exchange energy. And A2 It not only raises the magnetic coupling of a between, but it guarantees a deployment of the above quality of a magnetic matter about decreasing iron loss. Weight pair power ratio [in / by this / a motor] (power to weight ratio) It can optimize.

[0018]
Although the thickness of the back iron part behind an armature coil 81 is large and should be just larger than the back iron part behind the field slot 80 300% from 10% as a relative rate of the field slot 80 and the armature slot 81 as a desirable configuration, what is necessary is more preferably large just 150% from 25%. the optimal field slot 80 and the armature slot 81 -- relative -- if it carries out comparatively, the thickness of the back iron part behind an armature coil 81 should be just larger than the back of the field slot 80 100% from 50%. Furthermore, the greatest width of face of an armature coil 81 is made large 80% from 20%, and should be more preferably larger just than the greatest width of face of a field coil 80 about 50%. As shown in drawing 9 , as for the field slot 80 and the armature slot 81, it is desirable that it is narrow at an outlet so that it may become the narrow openings 82 and 83 in a rotator 79 and the location which counters. Since the lap of a fixed include angle arises substantially between the pole of a rotator, and the pole of a stator irrespective of the location of a rotator, the magnetic reluctance in the magnetic path as which this is detected with a coil guarantees an almost fixed thing about the location of a rotator. Moreover, as shown in drawing 9 , this is guaranteed also by forming the pole of a rotator so that it may have the width of face of a big pole which has sufficient lap to the pole of an adjacent stator. Although it approves, if differences among some are substantially [it is desirable and / the width of face of opening 82 / as the width of face of opening 83] the same, they are good.
[0019]
Drawing 10 shows the magnetic-flux switch motor 87 equipped with the stator 88 of eight poles, and the rotator 89 of four poles. In this case, a stator 88 has the angle 86 cut in slanting [slight], and has the rectangular cutting plane substantially. Since the cutting plane of such a stator can equip the outside of a field slot with the back iron part of considerable thickness so that iron loss may be minimized by performing suitable arrangement of the field slot 90 of arranging four armature slots 91 so that angle 86 may be countered, and the armature slot 91, it can be said that it is advantageous. Furthermore, since it can have a back iron part thick in this way according to the gestalt of the proper of a stator 88 It is not required to make the stator slot 91 very shallower than the field slot 90. (It was shown in drawing 9 it is the same as that of having been required in the operation gestalt) To instead of, it is an armature coil A1. And A2 The armature slot 91 can be made deeper than it deeply to the same extent with the field slot 90 so that the capacity which increased to the sake can be supplied. According to the angle 86 cut in slanting [slight], a motor can also be set to the package which has a circular cross section substantially.
[0020]
in order to decrease the iron loss by the magnetic-flux reversal in the stator behind an armature-winding slot, thickness of the back iron part behind each armature-winding slot is made larger than the thickness of the back iron part behind each field-winding slot -- like -- it is also possible to consider other operation gestalten within the limits of this invention of forming the slot of a field winding and an armature winding in a stator, and/or arranging.
[Brief Description of the Drawings]
[Drawing 1]
Drawing 1 a and 1b are the explanatory views showing the conventional magnetic-flux switch motor (flux-switching motor), and show two excitation modes in each drawing.
[Drawing 2]
Drawing 2 a and 2b are the explanatory views showing the conventional magnetic-flux switch motor, and show two excitation modes in each drawing.
[Drawing 3]
Drawing 3 is WO 98/05112. It is the explanatory view showing the coil of the stator of the magnetic-flux switch motor indicated in the number.
[Drawing 4]
Drawing 4 is WO 98/05112. It is the explanatory view showing the coil of the stator of the magnetic-flux switch motor indicated in the number.
[Drawing 5]
Drawing 5 is the circuit diagram showing the circuitry for exciting the field winding and armature winding concerning 1 operation gestalt of this invention.
[Drawing 6]
Drawing 6 is the explanatory view showing the outline of the magnetic-flux path by two excitation modes in the above-mentioned operation gestalt of this invention.
[Drawing 7]

Drawing 7 is the explanatory view showing the outline of the magnetic-flux path by two excitation modes in the above-mentioned operation gestalt of this invention.
[Drawing 8]
Drawing 8 is the explanatory view showing the outline of the magnetic-flux path by two excitation modes in the above-mentioned operation gestalt of this invention.
[Drawing 9]
Drawing 9 is a sectional view in radial [concerning 1 operation gestalt of this invention].
[Drawing 10]
Drawing 10 is a sectional view in radial [of the example of a complete-change form].

[Translation done.]

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3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1 a]

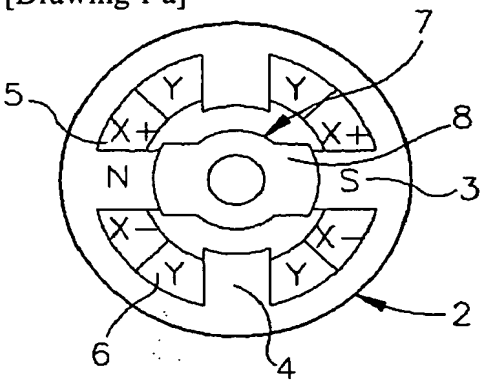


FIG 1a

[Drawing 1 b]

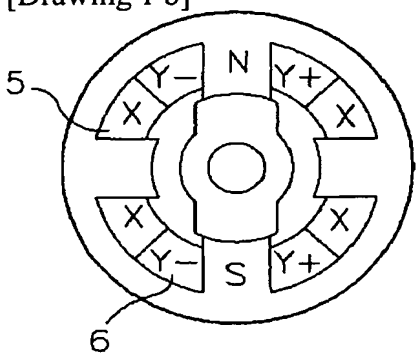


FIG 1b

[Drawing 2 a]

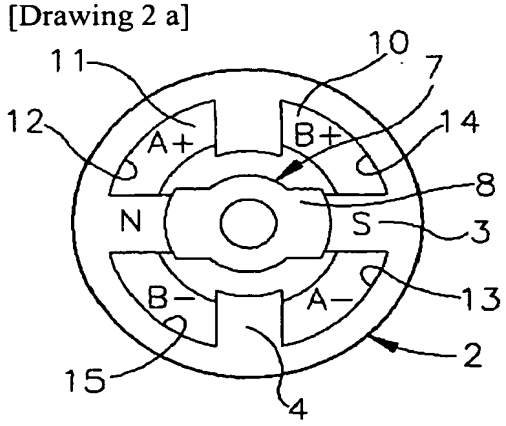


FIG 2a

[Drawing 2 b]

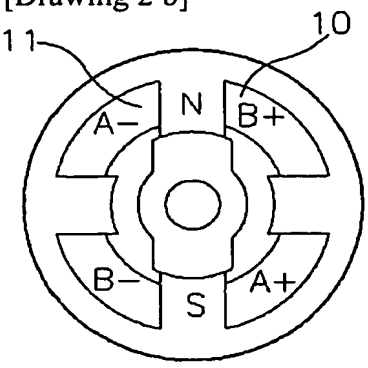
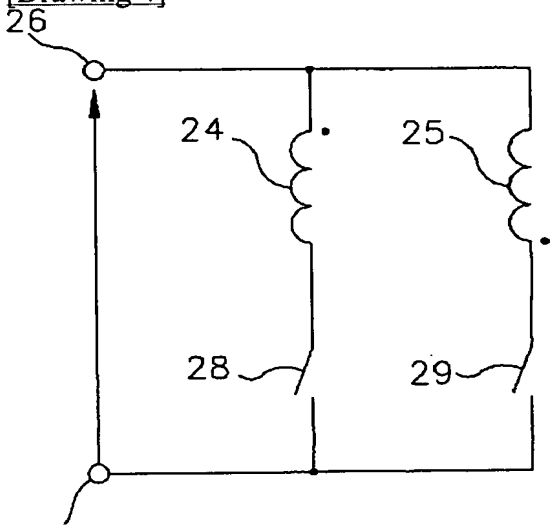
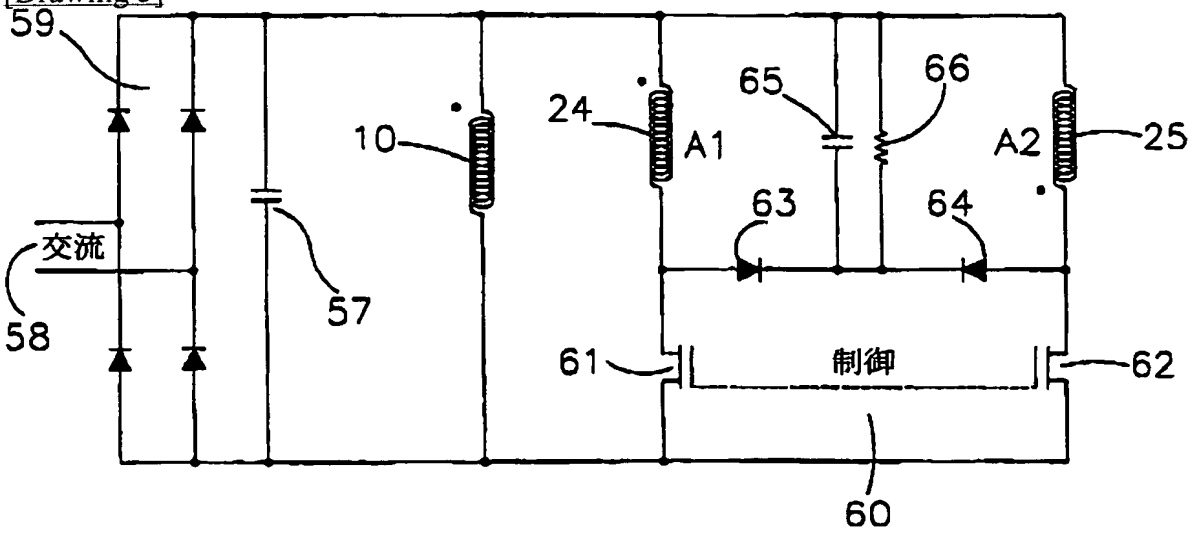


FIG 2b

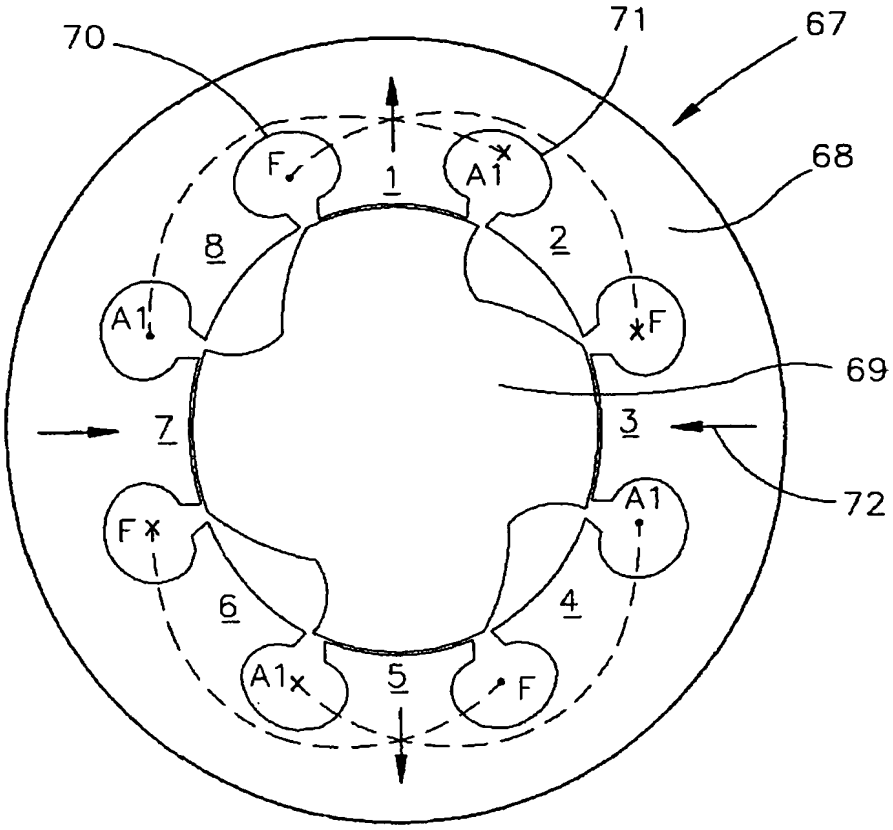
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Drawing 7]

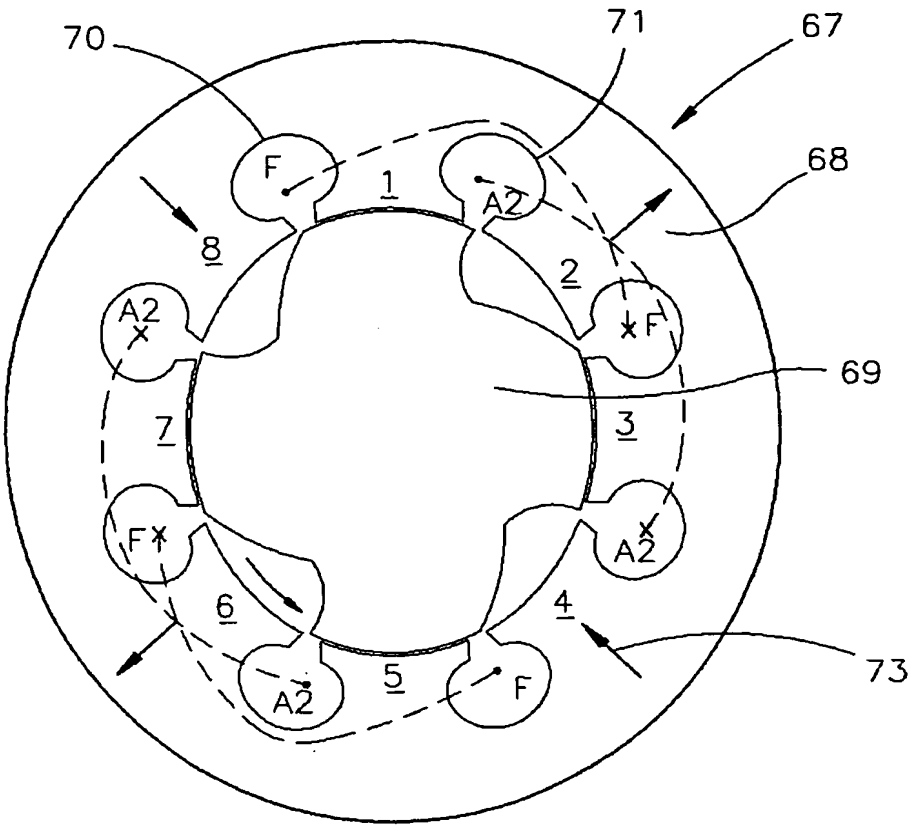
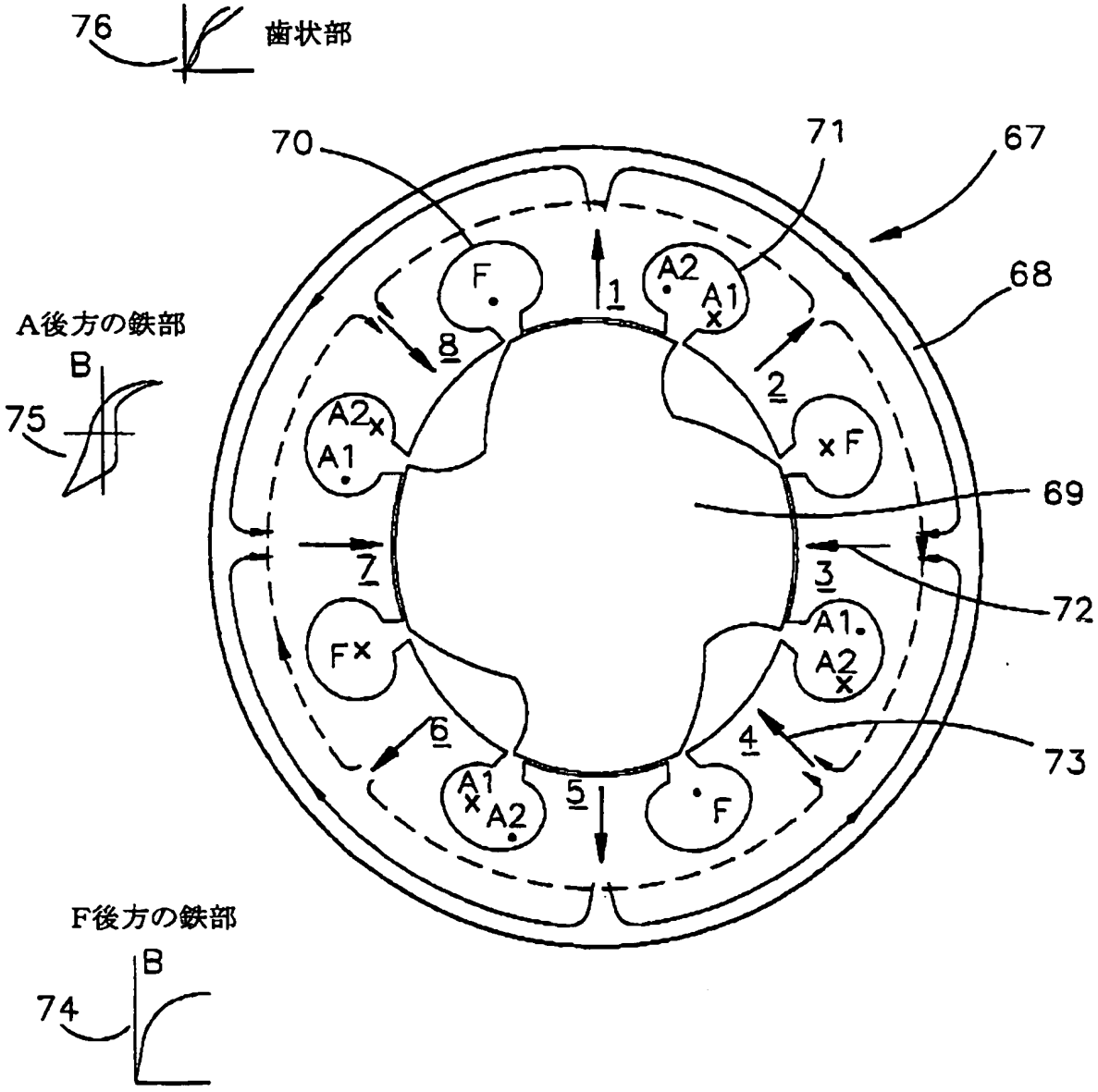


FIG 7

[Drawing 8]


76
歯状部
70
71
67
68
69
72
73
A後方の鉄部
B
75
F後方の鉄部
B
74
F
A2
A1
A2
A1
A2
A1
F
A1
A2
F
1
2
3
4
5
6
7
8

[Drawing 9]

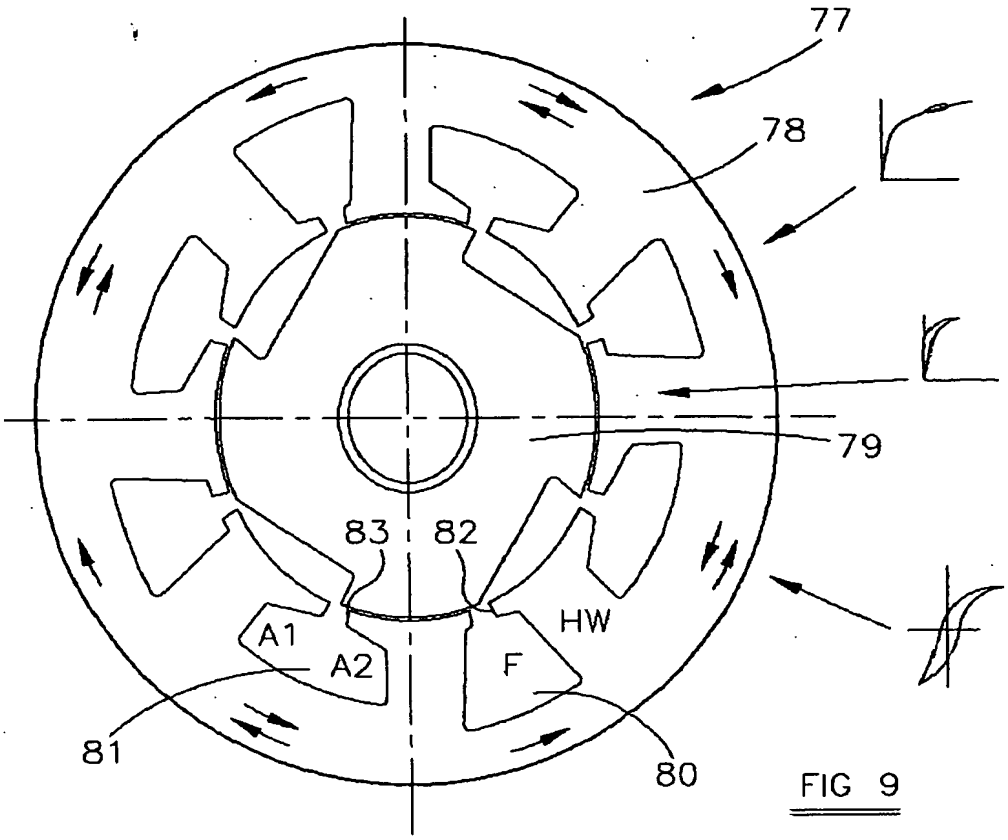


FIG 9

[Drawing 10]

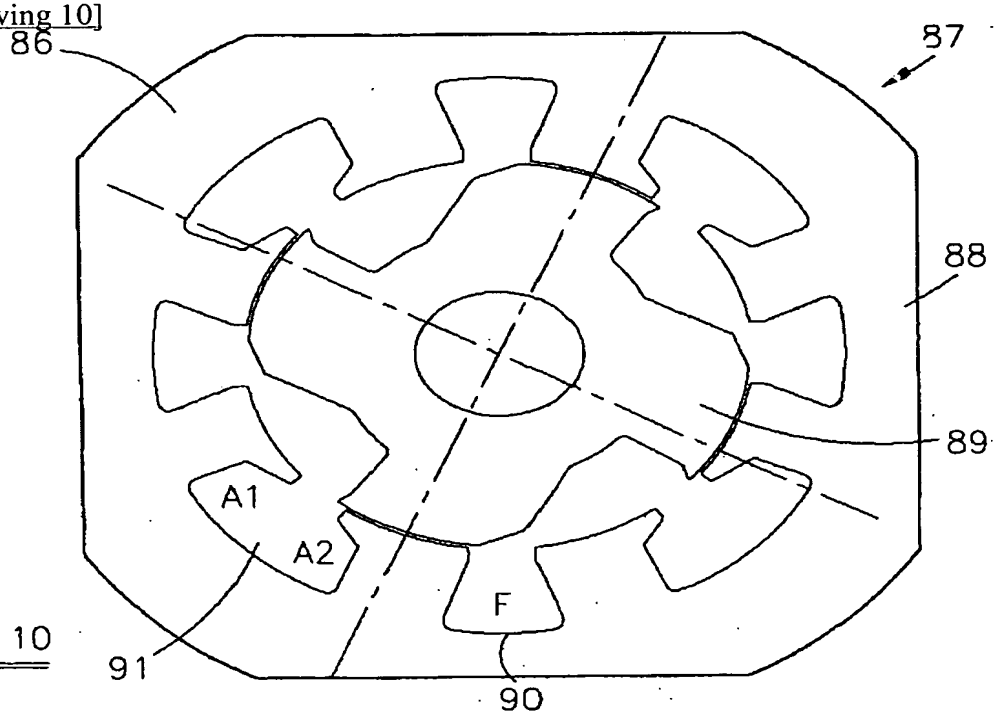


FIG 10

[Translation done.]